REMARKS

Claims 1-19 are currently pending in the present application.

Claims 20-27 have been canceled, without prejudice to the filing of one or more divisional applications. Claims 1, 12 and 17 have been amended to clarify that the change in index of refraction which is detected during the planarizing process is a change in the index of refraction between the first and second insulating layers. It is submitted that this amendment is made solely for the purposes of clarifying the detection which was already present in the claims and that the scope of the claims as amended is no narrower than the original claims. Claims 1-7, 11-15 and 17-19 have been amended to delete the allegedly objectionable phrase "the step(s) of" in response to the Examiner's objections set forth in paragraph 2 of the Office Action. Support for the amendments made herein can be found throughout the specification, for example, in paragraph [024]. No new matter has been introduced by the amendments made herein. Additionally, no additional claims fees are necessitated by the amendments made herein. A complete listing of all claims ever presented is contained herein in accordance with 37 C.F.R. §1.121(c)(1). Thus, entry of the amendments made herein is proper and respectfully requested.

In the Office Action, the Examiner objects to claim 11, asserting that the phrase "further comprising *the* step of" is allegedly informal in that a new step is being introduced. As indicated above, Applicants have amended the claims to remove the "the step(s) of" in all claims where steps are introduced. Withdrawal of the objection is respectfully requested.

In the Office Action, the Examiner rejects claims 1-2, 4-12, 14-17 and 19 under 35 U.S.C. §103(a), as being unpatentable over U.S. Patent No. 6,465,351 of Jeong ("Jeong"), in combination with U.S. Patent Publication No. US2004/0005769 of Mikolas ("Mikolas"). Specifically, the Examiner contends that Jeong discloses a method of manufacturing a semiconductor device comprising the steps of providing a semiconductor wafer with a patterned layer, forming a first insulating layer over the patterned layer, forming a second insulating layer over the first insulating layer, and removing the second insulating layer by a planarizing process. Additionally, the Examiner argues that the first insulating layer inherently has a first index of refraction and the second insulating layer inherently has a smaller index of refraction. The Examiner additionally notes that Jeong discloses that the first insulating layer serves as a chemical mechanical polishing stopping layer for endpoint detection. The Examiner acknowledges that Jeong fails to disclose how the planarizing step is ceased and lacks any disclosure regarding the detection of a change in the index of refraction during the planarizing process.

However, the Examiner argues that Mikolas discloses methods of detecting a planarization endpoint in chemical mechanical planarization "wherein a detectable target is located at the endpoint and then detected during the CMP planarization." (*See*, the Office Action, page 4). The Examiner additionally cites paragraph number [0055] of the Mikolas reference in an apparent effort to establish the disclosure of a method of detecting a change between varying indices of refraction. The cited paragraph of Mikolas reads as follows:

> "[0055] As a modification to the etching processes, a thin layer of a third material can be deposited on the first layer after etching of the grating. This material (16 in Fig. 2) can be deposited to either conform to the grating pattern (see Fig. 2a) or as a directional sputter or evaporation (see Fig. 2b). Optionally third layer (16) may be highly reflective in order to provide the difference in indexes of defraction necessary for observance of an optical effect, as discussed above. For example, the layer can be a very high index of refraction (e.g., amorphous silicon or other semiconductors) or can be highly reflective (e.g., a metal)."

The Examiner argues that it would have been obvious to one of ordinary skill in the art at the time Applicants' invention was made to have employed the process of Jeong with the endpoint detection method allegedly disclosed in Mikolas "since the endpoint detection of Mikolas would provide the manufacturing process of Jeong with 'accurately and reliably indicate when the planarizing process is complete'." (*See*, the Office Action, page 4).

Applicants strenuously, but respectfully, traverse the Examiner's rejection and the arguments and contentions set forth in support thereof for the following reason. The Examiner has failed to satisfy the criteria necessary to establish a *prima facie* case of obviousness based upon the cited references.

At the outset, Applicants would like to highlight for the Examiner the fact that their claimed invention is directed to methods of manufacturing semiconductor devices, wherein the methods comprise providing a wafer having a patterned layer, forming a first insulating layer over the patterned layer, forming a second insulating layer over the first insulating layer, removing the second insulating layer by a planarizing process, and *detecting a change in index of refraction between the first insulating layer and the second insulating layer during the planarizing process.*

It is well-settled that in order to establish a *prima facie* case of obviousness, the Examiner must satisfy three basic criteria. First, there must be some suggestion or motivation, in the references, to modify the reference or to combine reference teachings. It is NOT sufficient to say that the reference(s) can be modified, without a teaching or suggestion as to the desirability of making the modification. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all of the claim elements. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in Applicants' disclosure. (*See,* M.P.E.P. §2143).

Contrary to the Examiner's arguments and contentions set forth in the Office Action, neither Jeong nor Mikolas teaches or suggests the forming of a first insulating layer and a second insulating layer on a semiconductor wafer having a patterned layer and removing the second insulating layer by a planarizing process wherein a change in index of refraction between the first and second insulating layers is detected during the planarizing process.

The Jeong reference discloses the use of a CMP stop layer for endpoint detection in the polishing process. The Examiner acknowledges that Jeong fails to teach or suggest the detecting of a change in index of refraction during the planarizing process.

Applicants respectfully submit that Mikolas fails to remedy this deficiency in the disclosure of Jeong. Mikolas is directed to the use of a *target* for detecting the endpoint of a CMP process. Mikolas specifically discloses the use of a periodic grating as such a target. Mikolas teaches the use of the target as an endpoint indicator. In other words, when the target is observed, the endpoint of the CMP process has been reached. Thus, when the predictable defraction of light resulting from the line-space pattern which is inserted into or in between various layers of the structure in Mikolas is detected, the endpoint has been reached. (*See*, Mikolas, ¶¶ [0028 – 0029]). In other words, Mikolas discloses the use of a pattern, or target, "inserted or in between" layers. Thus, a pattern of light defraction produced by an inserted element is observed, not a change in refraction between a first and a second insulating layer.

In the portion of Mikolas cited by the Examiner, it is suggested that an additional material conforming to the grating pattern be deposited to provide enhanced contrast in optical properties in order to more easily observe the target (*i.e.*, optical effect produced by a pattern). In this manner, Mikolas suggests the use of a material which is highly reflective "in order to provide the difference in defraction necessary for observance of an optical effect…." (*See*, Mikolas, paragraph [0055]). Thus, the additional material amplifies the inserted pattern (i.e., target), nothing more.

Applicants respectfully submit that Mikolas fails to disclose detecting a change in index of refraction between a first insulating layer and a second insulating layer, as claimed.

Moreover, Applicants respectfully submit that one of ordinary skill in the art would not be motivated to combine and modify the references, as necessary, in order to arrive at Applicants' claimed invention. Mikolas does not disclose detection of the claimed change in index of refraction between the first insulating layer and the second insulating layer, and instead, discloses the insertion of a distinct target for producing an optical effect. One of ordinary skill in the art would not be motivated to omit a specifically taught element of the Mikolas reference (*i.e.*, the target) in order to achieve such an effect in Jeong or any other reference. Furthermore, given that the combination and modification of the cited references which would be necessary to arrive at Applicants' claimed invention would necessitate the complete omission of one of the elements required in the Mikolas reference, it cannot be said that one of ordinary skill in the art would have a reasonable expectation of successfully making such a combination and modification.

Accordingly, Applicants respectfully submit that the Examiner has failed to establish a *prima facie* case of obviousness based upon the Jeong and Mikolas references. Reconsideration and withdrawal of the rejection are respectfully requested.

In the Office Action, the Examiner rejects claims 3, 13 and 18 under 35 U.S.C. §103(a), as being unpatentable over Jeong and Mikolas, in view of U.S. Patent No. 5,516,729 of Dawson, *et al.* ("Dawson"). Specifically, the Examiner contends that the combination of Jeong and Mikolas discloses "substantially all" of the instantly claimed invention, but acknowledges that the references lack any disclosure of the steps of removing a portion of the first insulating layer by a planarizing process when the change in index of refraction is detected or the endpoint is determined. However, the Examiner argues that Dawson discloses methods of planarizing semiconductors wherein both a second insulating layer and a first insulating layer are removed. The Examiner argues that it would have been obvious to one of ordinary skill in the art at the time Applicants' invention was made to have combined Jeong and Mikolas, and further employed the processes disclosed in Dawson because this "would provide the combination process with a profile slightly elevated from the upper surface of the patterned layer." (*See*, the Office Action, pages 5-6).

Applicants respectfully traverse the Examiner's rejections and the arguments and contentions set forth in support thereof for the following reason. Applicants submit that the Examiner has failed to establish a *prima facie* case of obviousness based upon the cited references.

As discussed above, the combination of Jeong and Mikolas fails to obviate Applicants' claimed invention. Applicants respectfully reiterate the arguments set forth above in that regard. Applicants further submit that Dawson fails to remedy the deficiencies of Jeong and Mikolas. Dawson does not contain any teaching or suggestion which would motivate one of ordinary skill in the art to use a method wherein the endpoint of a chemical mechanical polishing process is detected by observing a change in index of refraction between a first and second insulating layers. Accordingly, Applicants respectfully submit that the Examiner has failed to establish a *prima facie* case of obviousness based upon the cited combination of references. Reconsideration and withdrawal of the rejection are respectfully requested.

In view of the remarks set forth above, Applicants respectfully submit that all pending claims patentably distinguish over the prior art of record and known to Applicants. Reconsideration, withdrawal of the rejections and a Notice of Allowance are respectfully requested.

Respectfully submitted,

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August 23, 2005
(Date)

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